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DISEQUILIBRIUM ECONOMETRICS ON MICRO DATA*

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ABSTRACT

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Estimation of macro-disequilibrium models is by now well-developed (see R. Quandt (1982), J.J. Laffont (1983) for recent surveys). Though the empirical macro results are interesting, they suffer from an excessive aggregation which prevents a sufficiently precise discussion of the nature of unemployment. This paper brings some empirical evidence to the construction of a more disaggregated view of disequilibrium. Individual data on firms collected by INSEE through periodic Business Surveys is used to construct the distribution of firms over the four possible disequilibrium regimes. Then the behavior of this distribution over time is analyzed. Effects of some macro variables which are suggested by a simple micro-disequilibrium model in the spirit of J. Muellbauer (1978) and E. Malinvaud (1981) are assessed through the estimation of a conditional logit model on panel data.

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The breakthrough paper on disequilibrium econometrics (R. C. Fair and D. M Jaffee (1972)) is now more than ten years old. R. Quandt (1982) has recently surveyed the development of the econometric methods dealing with the particular non-linear models generated by fix-price models. J. J. Laffont (1983) has summarized and discussed the main estimation results of macro-disequilibrium models. Though these empirical results are interesting, they suffer from an excessive aggregation which prevents a sufficiently precise discussion on the nature of unemployment (classical unemployment vs. Keynesian unemployment) and on the appropriate corrective economic policies.

The purpose of this paper is to bring some empirical evidence to the construction of a more disaggregated view of disequilibrium by using individual data on firms collected by the Institut National de la Statistique et des Etudes Economiques (INSEE) through periodic Business Survey Tests.[1] A great potential of this more disaggregated approach is the ability to study the relative shares of classical and Keynesian unemployment. For policy purposes it is also important to explain why a given sector is in one type of unemployment or the other.

The paper is organized as follows. Section 1 introduces a micro-disequilibrium model in the spirit of J. Muellbauer (1978) and E. Malinvaud (1981). The model is used to motivate the variables that are considered for explaining the regimes experienced by a firm. Section 2 presents the data and describes how the indicator of the regime in which a firm is can be constructed from the firm's answers to the INSEE surveys. The resulting distribution of the sample of firms over the four possible disequilibrium regimes is then discussed. Section 3 presents some general remarks on the estimation of conditional logit models on panel data as well as on the general form of the models that we propose to estimate. Section 4 studies the dynamics of the regime distribution by introducing the explanatory variables suggested by our theoretical model of Section 1. Section 5 concludes the paper.

1. A Disequilibrium Model for Micro Data

Let us consider a simple disaggregated model in the spirit of J. Muellbauer (1978) and E. Malinvaud (1981). The production function of firm i at date t is:

$$y_{it} = f_i(l_{it}, k_{it})$$

where l_{it} is the labor input and k_{it} is the capital input.

Let $\bar{y}_{it}$ be the efficient production level given the price system. This level depends on individual characteristics of the firm a_i, on the local wage it faces on the local labor market, w_{it}, on the average wage level of the economy $\bar{w}_t$ and on exogenous variables z_t:

$$\bar{y}_{it} = a_i - bw_{it} + c_i z_t + d_i \bar{w}_t.$$

Let $\hat{y}_{it}$ be the production level of firm i which would lead to full employment on its local labor market. This level is considered as exogenous in our analysis. Let $\hat{y}_t = \sum_i \hat{y}_{it}$. Then:

$$\begin{aligned}\sum_i (\bar{y}_{it} - \hat{y}_{it}) &= \sum_i a_i - b\sum_i w_{it} + (\sum_i c_i) z_t + (\sum_i d_i)\bar{w}_t - \sum_i \hat{y}_{it} \\ &= A - bn\bar{w}_t + Cz_t + D\bar{w}_t - \hat{y}_t\end{aligned}$$

where n is the number of firms.

For firm i, we can write:

$$\begin{aligned}\bar{y}_{it} - \hat{y}_{it} &= \frac{1}{n}\sum_j (\bar{y}_{jt} - \hat{y}_{jt}) + \varepsilon_{it} \\ &= \frac{A}{n} + (\frac{D}{n} - b)\bar{w}_t + \frac{C}{n} z_t - \frac{\hat{y}_t}{n} + \varepsilon_{it}\end{aligned}$$

with

$$\varepsilon_{it} = a_i - \frac{A}{n} - b(w_{it} - \bar{w}_t) + (c_i - \frac{C}{n})z_t + (d_i - \frac{D}{n})\bar{w}_t - (\hat{y}_{it} - \frac{\hat{y}_t}{n}).$$

We obtain an equation which explains the variable $(\bar{y}_{it} - \hat{y}_{it})$ for firm i with macroeconomic variables and with a random personalized effect. When possible, these individual effects must be explained. For example, the difference between the local real wage and the real wage of the economy can be explained by forecasting errors in demand as:

$$w_{it} - \bar{w}_t = h(e_{ity} - \bar{e}_{ty}) + \xi_{it}$$

where e_{ity} is the forecasting error made by firm i, $\bar{e}_{ty}$ is the mean of these errors, and ξ_{it} is a zero mean random variable.

Leaving the unexplained individual deviations in the error term we obtain an equation that can be estimated on individual data:

$$\bar{y}_{it} - \hat{y}_{it} = \underline{a} + \underline{b}\bar{w}_t + \underline{c}\ z_t + h(e_{ity} - \bar{e}_{ty}) + \tilde{\varepsilon}_{it} \qquad (1)$$

The demand anticipated by firm i is explained by:

$$d^a_{it} = \alpha_i + \beta_i g_t + \gamma_i \bar{w}_t + \gamma_i x_t$$

where g_t is public expenditures, w_t the wage level in the economy, and x_t a vector of exogenous variables. Then:

$$\sum_i (d^a_{it} - \hat{y}_{it}) = \alpha + \beta g_t + \gamma \bar{w}_t + \delta x_t - \hat{y}_t$$

with $\alpha = \sum_i \alpha_i$; $\beta = \sum_i \beta_i$; $\gamma = \sum_i \gamma_i$; $\delta = \sum_i \delta_i$.

For firm i, we can write:

$$d^a_{it} - \hat{y}_{it} = \frac{1}{n}\sum_j (d^a_{jt} - \hat{y}_{jt}) + \eta_{it} = \frac{\alpha}{n} + \frac{\beta}{n} g_t + \frac{\alpha}{n}\bar{w}_t + \frac{\delta}{n} x_t + \eta_{it}$$

where

$$\eta_{it} = \alpha_i - \frac{\alpha}{n} + (\beta_i - \frac{\beta}{n}) g_t + (\gamma_i - \frac{\gamma}{n})\bar{w}_t + (\delta_i - \frac{\delta}{n}) x_t - (y_{it} - \frac{\hat{y}_t}{n}).$$

Explaining partially individual deviations, we finally obtain another equation which can be estimated on individual data:

$$d^a_{it} - \hat{y}_{it} = \underline{\alpha} + \underline{\beta} g_t + \underline{\gamma}\bar{w}_t + \underline{\delta} x_t = k(e_{ity} - \bar{e}_{ty}) + \tilde{\eta}_{it} \qquad (2)$$

Given (1) and (2) we obtain the following classification:[2]

TABLE 1: DISEQUILIBRIUM REGIMES

	$\hat{y}_{it} > \inf(d^a_{it}, \bar{y}_{it})$	$\hat{y}_{it} < \inf(d^a_{it}, \bar{y}_{it})$
$d^a_{it} < \bar{y}_{it}$	Keynesian Unemployment (KU)	Under Consumption (UC)
$d^a_{it} > \bar{y}_{it}$	Classical Unemployment (CU)	Repressed Inflation (RI)

The probability of each regime is then obtained as:

$$\begin{aligned}
Pr(KU) &= Pr(d^a_{it} - \bar{y}_{it} < \text{ and } d^a_{it} - \hat{y}_{it} < 0) \\
&= Pr((d^a_{it} - \hat{y}_{it}) + (\hat{y}_{it} - \bar{y}_{it}) < 0 \text{ and } d^a_{it} - \hat{y}_{it} < 0) \\
Pr(UC) &= Pr((d^a_{it} - \hat{y}_{it}) + (\hat{y}_{it} - \bar{y}_{it}) < 0 \text{ and } d^a_{it} - \hat{y}_{it} > 0) \\
Pr(CU) &= Pr((d^a_{it} - \hat{y}_{it}) + (\hat{y}_{it} - \bar{y}_{it}) > 0 \text{ and } \bar{y}_{it} - \hat{y}_{it} < 0) \\
Pr(RI) &= Pr((d^a_{it} - \hat{y}_{it}) + (\hat{y}_{it} - \bar{y}_{it}) > 0 \text{ and } \bar{y}_{it} - \hat{y}_{it} > 0)
\end{aligned}$$

From (1) and (2), the qualitative variable representing the regime in which a firm is has a probability law which depends on all the variables we have singled out: public expenditures, wage levels, and forecasting errors. Finally, if the random variables $\tilde{\varepsilon}_{it}$, and $\tilde{\eta}_{it}$ are autocorrelated, we must introduce the regime of period t-1 in the explanation of firm i's regime in period t.

2. Description of Data and Construction of Variables

This section presents the data that is used in our empirical analysis. As suggested by the previous theoretical disaggregated disequilibrium model, we need to use both individual and aggregate data.

a. Individual Data

Our micro data has been collected by INSEE from about 4000 firms through periodic Business Survey Tests.[3] These Survey Tests were taken three times a year (in June, November, and March) from June 74 to June 78, and four times a year (in June, October, January, and March) from June 78 to June 82.

Only single product firms are retained in the sample. Each firm was also classified according to the nature of its product into one of the following five sectors:

1. Agricultural and Food Industries,
2. Intermediary Goods,
3. Professional Equipment,
4. Automobile, Transportation,
5. Consumption Goods.

From the firm's answers to these surveys, two qualitative variables were constructed: (i) an indicator of surprise with respect to the demand received by the firm for its product, and an indicator of the regime experienced by the firm during the period.

The demand surprise indicator, denoted MSD, is constructed from the answers to the following questions appearing in each survey:

"Indicate the probable change in demand for your product until the next survey: increasing, stable, decreasing."

"Indicate the change in demand for your product since the last survey: increasing, stable, decreasing."

From two successive surveys, we can readily define the variable MSD as:

MSD = 1 if the firm has over-evaluated its demand,

MSD = 2 if the firm has correctly evaluated its demand,

MSD = 3 if the firm has under-evaluated its demand.[4]

Let us now turn to the construction of the regime indicator IR. In the spirit of our micro-disequilibrium model we are reasoning as if each firm has its local product market and its local labor market. Let IQ and IL be respectively the indicators of the states of the product market and of the labor market that correspond to the classification obtained in Table 1. Thus:

$$\begin{aligned}
IL &= 1 \quad \text{if} \quad \hat{y}_{it} > \inf(d^a_{it}, \bar{y}_{it}), \\
IL &= 2 \quad \text{if} \quad \hat{y}_{it} < \inf(d^a_{it}, \bar{y}_{it}), \\
IQ &= 1 \quad \text{if} \quad d^a_{it} < \bar{y}_{it}, \\
IQ &= 2 \quad \text{if} \quad d^a_{it} > \bar{y}_{it}.
\end{aligned}$$

Information on the indicators IQ and IL can be obtained from the INSEE surveys since in these surveys firms are asked questions about their perceived constraints on their product and labor markets. In this paper, we shall only present the simplest of the different methods that we used to construct IQ and IL.

Specifically, the indicator IQ is obtained from the answer to the question:

"If you receive more orders could you produce more with your actual capacities?"

If the firm answers YES we presume, following E. Malinvaud's remark (1980, p.73), that the firm is constrained on its good market (IQ=1), while if the firm answers NO we presume that the firm is not constrained on its good market (IQ=2).

Similarly, the indicator IL is obtained from the answer to the question:

"Do you have now difficulties to recruit?"

If the firm answers YES, we presume that it is constrained on its labor market (IL=2), while if the firm answers NO we presume that it is not constrained on its labor market (IL=1).

There are obviously some problems with the interpretation to give to these answers; However, various alternative ways of using the answers to the INSEE surveys do not change the qualitative features of the following results as well as the empirical results presented in Section 4.[5]

Provided that a firm's answers to both of these questions are available it is possible to classify that firm in one of the four possible disequilibrium regimes. Specifically,

IR = 1 (Keynesian Unemployment) if IQ = 1 and IL = 1,

IR = 2 (Under Consumption) if IQ = 1 and IL = 2,

IR = 3 (Classical Unemployment) if IQ = 2 and IL = 1,

IR = 4 (Repressed Inflation) if IQ = 2 and IL = 2.

According to this definition of the regime indicator we obtain the following tables which present for the whole sample and for each of our five sectors, the distribution of the firms over the four possible disequilibrium regimes.

These results can be compared with the ex-post probabilities of the different regimes obtained by P. Artus, G. Laroque,and G. Michel (1982). One major feature of their results is obtained here: namely, the predominance of the Keynesian unemployment regime.[6]

It would be interesting to comment in detail these tables in the light of the french conjuncture over the period 75-82. We shall only mention two important attempts that were made during this period to decrease unemployment with classical Keynesian policies: the Chirac experiment from June 75 to June 76 and the Mauroy experiment from June 81 to June 82. Both share the same features: a strong decline in the proportion of firms in the Keynesian unemployment regime with an increase in all other regimes. The Mauroy experiment appears less effective with a stronger relative increase in the proportion of firms in the classical unemployment regime; this is not surprising given that in the Mauroy experiment the low real wages have been increasing substantially. Note also the dynamics after the Chirac experiment: the proportion of firms in the Keynesian unemployment regime

TABLE 2: ALL FIVE SECTORS

DATE	SAMPLE	KEYNESIAN UNEMPLOYMENT (%)	UNDER CONSUMPTION (%)	CLASSICAL UNEMPLOYMENT (%)	REPRESSED INFLATION (%)
75 03	1,741	67.03	15.51	11.77	5.69
75 06	1,818	69.70	15.51	9.79	5.00
75 11	1,869	68.27	14.87	11.40	5.46
76 03	1,842	62.81	18.24	11.67	7.28
76 06	1,787	51.82	22.50	13.43	12.25
76 11	1,829	55.28	20.78	13.72	10.22
77 03	1,923	57.88	18.82	14.30	9.00
77 06	1,917	58.53	18.62	14.45	8.40
77 11	2,119	60.97	18.12	13.07	7.84
78 03	2,013	62.49	18.33	12.57	6.61
78 06	2,031	59.87	18.07	14.33	7.73
78 10	1,785	60.62	17.54	14.73	7.11
79 01	2,036	60.95	16.85	15.28	6.92
79 03	1,988	60.82	15.79	16.35	7.04
79 06	1,965	56.69	15.98	18.73	8.60
79 10	1,996	54.61	16.33	20.14	8.92
80 01	1,919	56.70	16.21	18.86	8.23
80 03	2,031	54.01	16.45	20.38	9.16
80 06	1,957	56.11	16.09	18.65	9.15
80 10	2,015	63.23	16.63	14.14	6.00
81 01	1,804	69.01	14.63	12.42	3.94
81 03	1,726	71.55	12.57	12.34	3.54
81 06	1,671	73.55	11.19	11.85	3.41
81 10	1,774	70.97	12.63	12.91	3.49
82 01	1,832	70.69	11.68	13.37	4.26
82 03	1,743	69.31	13.42	12.79	4.48
82 06	1,648	63.96	15.53	14.93	5.58

TABLE 3: AGRICULTURAL AND FOOD INDUSTRIES

DATE	SAMPLE	KEYNESIAN UNEMPLOYMENT (%)	UNDER CONSUMPTION (%)	CLASSICAL UNEMPLOYMENT (%)	REPRESSED INFLATION (%)
75 03	190	75.79	14.21	9.47	0.53
75 06	207	72.95	13.04	12.56	1.45
75 11	207	68.60	11.11	15.94	4.35
76 03	219	71.69	15.07	11.87	1.37
76 06	201	66.17	16.91	12.94	3.98
76 11	222	63.06	14.86	17.12	4.96
77 03	225	69.33	15.11	12.00	3.56
77 06	222	65.77	15.77	13.51	4.95
77 11	236	61.02	12.71	20.34	5.93
78 03	226	63.27	13.72	19.47	3.54
78 06	225	65.33	14.22	16.89	3.56
78 10	201	62.18	11.94	20.40	4.48
79 01	231	69.70	9.52	18.18	2.60
79 03	219	69.41	11.42	15.98	3.19
79 06	219	65.30	11.87	19.18	3.65
79 10	220	66.82	11.36	16.36	5.46
80 01	210	69.05	8.57	19.05	3.33
80 03	228	66.67	11.40	18.86	3.07
80 06	218	66.51	11.01	18.81	3.67
80 10	235	65.53	12.77	16.60	5.10
81 01	206	68.93	13.11	14.56	3.40
81 03	176	70.45	11.36	16.48	1.71
81 06	176	71.59	7.96	18.18	2.27
81 10	188	70.75	9.04	17.55	2.66
82 01	212	73.59	9.43	14.15	2.83
82 03	190	70.53	13.68	13.68	2.11
82 06	173	67.05	13.29	15.61	4.05

TABLE 4: INTERMEDIARY GOODS

DATE	SAMPLE	KEYNESIAN UNEMPLOYMENT (%)	UNDER CONSUMPTION (%)	CLASSICAL UNEMPLOYMENT (%)	REPRESSED INFLATION (%)
75 03	568	61.09	19.01	13.21	6.69
75 06	620	67.26	16.77	10.00	5.97
75 11	642	68.85	16.35	9.97	4.83
76 03	628	65.13	19.90	9.40	5.57
76 06	619	50.24	26.50	13.73	9.53
76 11	626	56.39	23.00	11.34	9.27
77 03	705	57.45	21.42	13.47	7.66
77 06	710	59.44	20.56	11.83	8.17
77 11	794	63.35	20.65	10.08	5.92
78 03	774	64.08	19.12	10.98	5.82
78 06	748	61.37	19.65	11.36	7.62
78 10	673	62.56	19.46	11.74	6.24
79 01	789	59.95	19.14	14.57	6.34
79 03	772	60.36	16.84	15.93	6.87
79 06	767	56.85	16.56	17.99	8.60
79 10	790	52.28	17.09	21.01	9.62
80 01	745	54.63	18.12	18.52	8.73
80 03	766	50.13	18.41	20.63	10.83
80 06	741	51.82	17.41	19.16	11.61
80 10	771	58.50	20.36	14.27	6.87
81 01	696	68.25	15.08	12.93	3.74
81 03	667	71.06	13.49	11.85	3.60
81 06	652	73.16	12.27	11.66	2.91
81 10	718	70.47	14.07	12.26	3.20
82 01	719	73.43	11.96	11.13	3.48
82 03	689	73.30	13.64	8.85	4.21
82 06	645	66.36	16.90	11.63	5.11

TABLE 5: PROFESSIONAL EQUIPMENT

DATE	SAMPLE	KEYNESIAN UNEMPLOYMENT (%)	UNDER CONSUMPTION (%)	CLASSICAL UNEMPLOYMENT (%)	REPRESSED INFLATION (%)
75 03	257	60.31	17.51	12.45	9.73
75 06	248	61.70	20.16	8.87	9.27
75 11	265	62.64	19.25	9.81	8.30
76 03	225	54.22	23.11	12.00	10.67
76 06	218	47.25	26.60	11.01	15.14
76 11	228	56.14	23.25	8.77	11.84
77 03	212	58.12	22.17	10.85	8.96
77 06	203	59.11	23.65	10.84	6.40
77 11	215	62.79	20.93	9.30	6.98
78 03	200	66.50	20.50	7.00	6.00
78 06	197	61.93	24.37	6.09	7.61
78 10	184	65.76	19.02	8.70	6.52
79 01	193	69.95	20.20	6.22	3.63
79 03	191	67.54	18.33	7.85	6.28
79 06	181	65.19	16.58	9.39	8.84
79 10	177	56.50	23.16	13.56	6.78
80 01	184	59.24	19.02	11.41	10.33
80 03	175	57.72	21.14	9.71	11.43
80 06	179	54.19	22.35	7.82	15.64
80 10	172	61.05	18.02	10.47	10.46
81 01	161	61.49	21.12	8.07	9.32
81 03	156	66.02	17.30	8.99	7.69
81 06	149	67.11	22.15	6.04	4.70
81 10	147	67.35	20.41	8.16	4.08
82 01	147	68.03	19.83	8.84	3.40
82 03	144	61.81	25.69	8.33	4.17
82 06	142	59.86	27.47	7.04	5.63

TABLE 6: AUTOMOBILE AND TRANSPORTATION

DATE	SAMPLE	KEYNESIAN UNEMPLOYMENT (%)	UNDER CONSUMPTION (%)	CLASSICAL UNEMPLOYMENT (%)	REPRESSED INFLATION (%)
75 03	51	78.43	13.73	5.88	1.96
75 06	59	84.75	11.86	1.70	1.69
75 11	57	71.93	15.79	5.26	7.02
76 03	51	58.82	17.65	11.77	11.76
76 06	59	47.46	22.03	15.26	15.25
76 11	56	53.57	23.21	12.50	10.72
77 03	47	57.45	12.77	14.89	14.89
77 06	50	56.00	12.00	20.00	12.00
77 11	47	70.21	14.89	10.64	4.26
78 03	51	70.59	15.69	9.80	3.92
78 06	51	66.67	13.72	13.73	5.88
78 10	43	69.77	13.95	6.98	9.30
79 01	48	72.92	14.58	10.42	2.08
79 03	45	82.22	4.45	13.33	0.00
79 06	44	75.00	11.36	11.37	2.27
79 10	43	62.79	9.30	23.26	4.65
80 01	40	67.50	17.50	15.00	0.00
80 03	42	52.38	26.19	9.52	11.91
80 06	36	44.45	16.67	19.44	19.44
80 10	37	62.16	16.22	10.81	10.81
81 01	36	77.78	16.66	2.78	2.78
81 03	39	71.80	20.51	5.13	2.56
81 06	37	89.19	8.11	2.70	0.00
81 10	36	77.78	11.11	8.33	2.78
82 01	30	73.34	10.00	13.33	3.33
82 03	34	73.53	17.65	5.88	2.94
82 06	39	69.23	12.82	15.39	2.56

TABLE 7: CONSUMPTION GOODS

DATE	SAMPLE	KEYNESIAN UNEMPLOYMENT (%)	UNDER CONSUMPTION (%)	CLASSICAL UNEMPLOYMENT (%)	REPRESSED INFLATION (%)
75 03	670	71.34	12.39	11.19	5.08
75 06	679	72.46	13.84	9.72	3.98
75 11	691	69.32	13.02	12.45	5.21
76 03	712	60.96	16.29	13.48	9.27
76 06	684	50.88	19.15	13.89	16.08
76 11	692	51.59	19.80	16.33	12.28
77 03	727	54.61	61.92	16.78	11.69
77 06	724	55.25	16.71	17.96	10.08
77 11	819	57.63	16.61	15.02	10.74
78 03	754	59.02	18.44	13.79	8.75
78 06	802	55.99	16.33	18.45	9.23
78 10	678	55.90	17.11	18.14	8.85
79 01	767	56.19	16.04	17.73	10.04
79 03	753	55.64	16.07	19.26	9.03
79 06	748	50.80	16.71	22.06	10.43
79 10	759	52.57	15.94	21.61	9.88
80 01	734	54.09	15.80	20.98	9.13
80 03	814	53.69	14.37	23.22	8.72
80 06	777	58.43	14.80	20.46	6.31
80 10	793	67.85	13.87	14.12	4.16
81 01	698	71.35	13.03	12.61	3.01
81 03	681	73.86	10.43	12.77	2.94
81 06	653	75.19	8.73	11.95	4.13
81 10	678	72.27	10.47	13.42	3.84
82 01	717	67.64	10.46	16.18	5.72
82 03	680	55.47	10.29	17.65	5.59
82 06	644	61.49	12.27	19.56	6.68

increases again, but the proportion of firms in the classical unemployment regime continues to increase.

Tables 3 to 7 also show differences with respect to sensibility among the five sectors: the intermediary good sector and professional equipment sector are the slowest to react; the automobile and transportation sector reacts quite strongly and rapidly; the consumption good sector reacts quickly but not as strongly.

Finally, the substantial increase in Keynesian unemployment from June 80 to January 81 seems to be due to the second oil crisis.

b. Macro Data

Some macroeconomic variables are used as additional explanatory variables. All the macroeconomic variables were dichotomized and constructed from appropriate series obtained from the Comptes Nationaux Trimestriels published by INSEE for the period under study. If IX denotes the dichotomous variable associated with the latent continuous variable X, then the dichotomization rule is:

IX = 1 if X is above a trend,

IX = 2 if X is below a trend,

where the trend is obtained by adjusting a line on the time series X.

Two sectorial indicators and two national indicators were constucted in this way. These are:

IGS : indicator of sectorial public expenditures,

IGT : indicator of total public expenditures,

ISB : indicator of the sectorial real cost of labor as measured by real gross wages, which include employer and employee social security payments and the like,

ISN : indicator of purchasing power as measured by real take-home pay, which includes personal income taxes for the whole economy.[7]

In addition, lags of these indicators are also used as explanatory variables. Specifically, if IX is an indicator, then

IX1 is the indicator lagged 3 months,

IX2 is the indicator lagged 6 months,

IX3 is the indicator lagged 9 months.

3. Estimation of Dynamic Conditional Models on Panel Data

All the models that we estimate are conditional logit models (see e.g., D. McFadden (1974), M. Nerlove and S. J. Press (1973,1976)) where the endogenous variable is the disequilibrium regime indicator IR. As a matter of fact, we consider a special case of the conditional logit model since all our explanatory variables are qualitative.

All our models are dynamic in the sense that they all include the 3 months lagged regime indicator IR1 as an explanatory variable. Thus we can think of the remaining explanatory variables as explaining the 3 months transition probability from one regime to another. Our models are therefore of the form:

$$IR \mid IR1, IA, IB, IC, \ldots$$

The parameterization used is the ANOVA parameterization (see M. Nerlove and S. J. Press (1976), Q. H. Vuong (1982)). As usual we restrict the effect of each explanatory variable to its bivariate effect (see footnotes 11 and 12).

Conditional logit models have been in general estimated on cross-section data only. The reason is that estimation of such models relies on the usual assumption that the observations are mutually independent, an assumption that is hardly justified in time series or panel data. Since we are ultimately interested in the effects of macro indicators such as IGT that therefore do not vary across individuals, it is necessary to use a panel data in order to identify these macro effects.

The purpose of this section is to justify our estimation procedure on theoretical grounds. As a matter of fact, our justification is valid for the estimation of any dynamic conditional model on panel data.

Suppose first that one has available a complete panel data on T equally spaced periods (t=1,...,T) for n individuals (i=1,...,n). Let Y_{it} be the endogenous random variable(s) observed at time t for the i-th individual. Let X_{it} and Z_t be vectors of explanatory variables where X_{it} vary across individuals while Z_t do not. For instance, X_{it} may be IR1 or MSD, while Z_t may be IGT or IGS.

Let $Y_{i,s}^{t}$ be the set of variables $\{Y_{i,s},Y_{i,s+1},\ldots,Y_{i,t}\}$ where $s\leq t$. We make the following assumptions:

ASSUMPTION A.1 (Model Specification):

For any i=1,...,n, and any t=h+1,...,T:

$$Pr(Y_{it}|Y_{i,-\infty}^{t-1},X_{i,-\infty}^{t},Z_{-\infty}^{t}) = Pr(Y_{it}|Y_{i,t-h}^{t-1},X_{i,t-h}^{t-1},Z_{t-h}^{t}).$$

where Pr(A|B) is the conditional density of the variables in A given the variables in B, and h is the maximum lag specified. It is assumed that h < T+1.

Given the choice of a family (in general parametric) of conditional distributions , Assumption A.1 is nothing else than the specification of the model of interest.

ASSUMPTION A.2 (Stability):

a. For any i=1,...,n, and any t,s in {h+1,...,T}:

$$Pr(Y_{it}|Y_{i,t-h}^{t-1},X_{i,t-h}^{t},Z_{t-h}^{t}) = Pr(Y_{is}|Y_{i,s-h}^{s-1},X_{i,s-h}^{s},Z_{s-h}^{s}),$$

b. For any i,j in {1,...,n}, and any t=h+1,...,T:

$$Pr(Y_{it}|Y_{i,t-h}^{t-1},X_{i,t-h}^{t},Z_{t-h}^{t}) = Pr(Y_{jt}|Y_{j,t-h}^{t-1},X_{j,t-h}^{t},Z_{t-h}^{t}).$$

Assumptions A2-a and A2-b respectively require that the conditional model of interest be stable across time and across individuals. Clearly some stability assumptions, which may not be as strong, are needed in order to estimate a model.

The next assumption deals with the sampling of individuals.

ASSUMPTION A.3 (Sampling): The n stochastic vector processes $\{(Y_{it},X_{it});t=-\infty,T\}$ for i=1,...,n are mutually independent given the stochastic process $\{Z_t; t=-\infty,T\}$, i.e. for any i:

$$(Y^T_{i,-\infty}, X^T_{i,-\infty}) \perp \{(Y^T_{j,-\infty}, X^T_{j,-\infty}); j \neq i\} \mid Z^T_{-\infty},$$

where $A \perp B \mid C$ denotes that A and B are conditionally independent given C.

For instance, if there are no macro variables Z_t, then Assumption A.3 simply means that the sampling of individuals is random.

ASSUMPTION A.4 (Exogeneity): For any i=1,...,n, and any t=1,...,T:

$$X^{+\infty}_{i,t+1}, Z^{+\infty}_{t+1} \perp Y_{i,-\infty} \mid X^t_{i,-\infty}, Z_t,$$

If there are no macro variables Z_t, then Assumption A.4 simply requires that Y_{it} does not Granger cause X_{it}, or equivalently that X_{it} is strictly exogenous to Y_{it} (see G. Chamberlain (1982), M. B. Bouissou, J. J. Laffont, and Q. H. Vuong (1983b)).

Assumptions A.1 to A.4 can be considered as the standard assumptions underlying the estimation of a dynamic conditional model on panel data.[8] It is worth noting that we obtain as a special case (h=1,T=1) the assumptions that are implicit in the estimation of a conditional model on a cross section, and as another special case (n=1) the assumptions that justify the estimation of a conditional model on a time series.

We now consider the likelihood function associated with the observations on the panel $\{Y_{it}, X_{it}, Z_t;\ i=1,\dots,n,\ t=1,\dots,T\}$. Since h may not be null, we shall in fact consider the conditional likelihood

function L_{YXZ} given all the variables prior to period h+1, i.e.:

$$L_{YXZ} = \Pr[((Y^T_{i,h+1}, X^T_{i,h+1}); i=1,\dots,n), Z^T_{h+1} \mid ((Y^h_{i,-\infty}, X^h_{i,-\infty}); i=1,\dots,n), Z^h_{-\infty}].$$

We have:

$$L_{XYZ} = L_{Y|XZ} \times L_{XZ}$$

with

$$L_{Y|XZ} = \Pr[(Y^T_{i,h+1}; i = 1,\dots,n) \mid ((Y^h_{i,-\infty}, X^T_{i,-\infty}); i = 1,\dots,n), Z^T_{-\infty}] \quad (3)$$

$$L_{XZ} = \Pr[(X^T_{i,h+1}; i = 1,n), Z^T_{h+1} \mid ((Y^h_{i,-\infty}, X^h_{i,-\infty}); i = 1,\dots n), Z^h_{-\infty}] \quad (4)$$

Since L_{YXZ} is the (conditional) likelihood for $(((Y^T_{i,h+1}, X^T_{i,h+1}); i=1,\dots,n), Z^T_{h+1})$ and since L_{XZ} is the (conditional) likelihood for $((X^T_{i,h+1}; i=1,\dots,n), Z^T_{h+1})$, it follows that $L_{Y|XZ}$ as defined in (3) is the conditional likelihood for $(Y^T_{i,h+1}; i=1,\dots,n)$ given $((X^T_{i,h+1}; i=1,\dots,n), Z^T_{h+1})$.[9]

We have:

$$\begin{aligned}
L_{Y|XZ} &= \prod_{t=h+1}^{T} \Pr[(Y_{i,t};\ i = 1,\dots,n) \mid ((Y^{t-1}_{i,-\infty}, X^T_{i,-\infty});\ i = 1,\dots,n), Z^T_{-\infty}] \\
&= \prod_{i=1}^{n} \prod_{t=h+1}^{T} \Pr[Y_{it} \mid ((Y^{t-1}_{j,-\infty}, X^T_{j,-\infty});\ j = 1,\dots,n), Z^T_{-\infty}] \\
&= \prod_{i=1}^{n} \prod_{t=h+1}^{T} \Pr[Y_{it} \mid Y^{t-1}_{i,-\infty}, X^T_{i,-\infty}, Z^T_{-\infty}] \\
&= \prod_{i=1}^{n} \prod_{t=h+1}^{T} \Pr[Y_{it} \mid Y^{t-1}_{i,-\infty}, X^t_{i,-\infty}, Z^t_{-\infty}]
\end{aligned}$$

where the first equation is an identity, the second and third equations follow from Assumption A.3, and the fourth equation from Assumption A.4. Moreover, it follows from Assumption A.1 that:

$$L_{Y|XZ} = \prod_{i=1}^{n} \prod_{t=h+1}^{T} \Pr[Y_{it} \mid Y_{i,t-h}^{t-1}, X_{i,t-h}^{t}, Z_{t-h}^{t}]$$

and from Assumption A.2 that:

$$L_{Y|XZ} = \prod_{i=1}^{n} \prod_{t=h+1}^{T} \Pr[Y=y_{it} \mid Y_h^1 = y_{i,t-h}^{t-1}, X_h^0 = x_{i,t-h}^{t}, Z_h^0 = z_{t-h}^{t}] \tag{5}$$

where y_{it}, $y_{i,t-h}^{t-1}$, $x_{i,t-h}^{t}$, z_{t-h}^{t} are the observed realizations of the random variables Y_{it}, $Y_{i,t-h}^{t-1}$, $X_{i,t-h}^{t}$, Z_{t-h}^{t}, and Y, Y_h^1, X_h^0, Z_j^0 are the random variables implicitly defined by the stability Assumption A.2.

Each of our conditional logit models is estimated by maximizing a conditional likelihood function of the form (5) with respect to some parameters. From the general properties of conditional maximum likelihood estimation (see E. B. Anderssen (1973), Q. H. Vuong (1983)) it follows that this procedure leads to consistent estimates. It is also worth noting from Equation (5) that the conditional likelihood $L_{Y|XZ}$ can be written as if all the observations were independent where one observation is an observation on a firm at a given period. In addition Equation (5) shows that we can pool all these n(T-h) observations.

Finally, as indicated in Section 2, the time length between two surveys varies from 2 to 5 months over the period under study. We have then considered only the terms in Equation (5) that correspond to periods for which a survey is available 3 months earlier, i,e. to the following dates: 7506, 7606, 7706, 8706, 7901, 7906, 8001, 8006, 8101, 8106, 8201, and 8206. The number of observations in each sector, where an observation corresponds to a firm for a given date, was:

Sector 1 : 1241 observations,

Sector 2 : 4885 observations,

Sector 3 : 2302 observations,

Sector 4 : 449 observations,

Sector 5 : 5293 observations.

4. Disequilibrium Dynamics

Our purpose is to explain using the variables that were mentioned in Section 1 the transition matrix associated with the four possible disequilibrium regimes. As indicated in the previous section, we restrict our analysis to the transition probability from one state to another 3 months later. Let T_+ be the transition matrix for the five sectors:

$$T_+ = \begin{array}{c} \begin{array}{cccc} KU & UC & CU & RI \end{array} \\ \left[\begin{array}{cccc} p(1/1) & p(1/2) & p(1/3) & p(1/4) \\ p(2/1) & p(2/2) & p(2/3) & p(2/4) \\ p(3/1) & p(3/2) & p(3/3) & p(3/4) \\ p(4/1) & p(4/2) & p(4/3) & p(4/4) \end{array}\right] \end{array} \begin{array}{c} \\ KU \\ UC \\ CU \\ RI \end{array}$$

where p(j/k) denotes the transition probability from state k to state j. Let T_i be the transition matrix for sector i.

From the observations pooled over the 12 periods that were singled out in the previous section we can obtain the following observed transition matrices:

$$T_+ = \begin{bmatrix} 85.82 & 24.69 & 24.31 & 12.13 \\ 7.00 & 64.24 & 2.74 & 18.53 \\ 5.73 & 2.32 & 65.45 & 14.51 \\ 1.45 & 8.74 & 7.51 & 54.84 \end{bmatrix}$$

$$T_1 = \begin{bmatrix} 89.74 & 27.49 & 19.74 & 16.12 \\ 4.66 & 68.52 & 0.31 & 12.90 \\ 4.95 & 0.79 & 75.23 & 14.51 \\ 0.63 & 3.18 & 4.70 & 56.45 \end{bmatrix}$$

$$T_2 = \begin{bmatrix} 85.76 & 25.25 & 23.83 & 12.41 \\ 7.74 & 64.76 & 2.43 & 14.67 \\ 5.44 & 1.76 & 66.42 & 17.60 \\ 1.05 & 8.22 & 7.30 & 55.30 \end{bmatrix}$$

$$T_3 = \begin{bmatrix} 85.66 & 21.67 & 27.85 & 8.19 \\ 8.44 & 68.11 & 4.45 & 23.20 \\ 3.74 & 2.01 & 57.93 & 7.85 \\ 2.13 & 8.20 & 9.74 & 60.75 \end{bmatrix}$$

$$T_4 = \begin{bmatrix} 86.98 & 25.83 & 30.86 & 9.30 \\ 6.62 & 59.16 & 1.23 & 34.88 \\ 4.56 & 2.50 & 56.79 & 6.97 \\ 1.82 & 12.50 & 11.11 & 48.83 \end{bmatrix}$$

$$T_5 = \begin{bmatrix} 84.52 & 25.15 & 24.39 & 13.91 \\ 6.34 & 60.59 & 3.22 & 18.48 \\ 7.37 & 3.56 & 64.89 & 16.30 \\ 1.75 & 10.69 & 7.49 & 51.29 \end{bmatrix}$$

It would be interesting to comment in detail these transition matrices. For instance, we can observe some close similarities among the five sectors such as a high probability of staying in the same regime. Also, the Keynesian unemployment regime appears to be almost an absorbing state. These qualitative features must, however, be taken with care since these transition probabilites are influenced by some macroeconomic variables that were not invariant over the period under study.

Table 8 presents a first set of estimation results that are obtained by using only the lagged regime indicator IR1 and the individual demand surprise indicator MSD.[10]

These results should be read as follows. When the upper tail probability (UTP) is larger than 5% it means that the current model cannot be rejected against the corresponding unconstrained (or saturated) model by a log-likelihood ratio test at the 5% significance level.[11] The number below an explanatory variable is the UTP in % of the chi-square Wald statistic that is used to test that the variable is significant. If this number is less than 5 it means that the suppression of the effect is rejected at the 5% significance level. When an explanatory variable other than IR1 is significant at the 5% level we give for the first category of that variable (IX=1) the signs of the effects on the four disequilibrium regimes.[12] For instance, (+,+,-,0) means that an over evaluation in demand (MSD=1) relatively increases the probabilities of being in regimes 1 and 2, decreases the probability of being in regime 3, and has no effect on the probability of being in regime 4.

TABLE 8: MODEL IR/IR1,MSD

Sector	IR / IR1	MSD	UTP
1	0%	18 (+,0,0,0)	10.7%
2	0%	0 (+,+,-,-)	5.53%
3	0%	$0.137.10^{-3}$ (+,+,-,-)	87.8%
4	0%	44.8 (0,0,0,0)	29.8%
5	0%	$0.133.10^{-12}$ (+,+,-,-)	24%

As expected from the observed transition matrices given above, we find that the lagged regime indicator IR1 is strongly significant for every sector. We also observe that the demand surprise indicator is strongly significant for sectors 2, 3, and 5, while it is not for sectors 1 and 4. Sector 1 (Agricultural and Food Industries) always gave poor results and we shall abstain from giving any explanation. On the other hand, the non-significance of the demand surprise indicator in sector 4 (Automobile and Transportation) is probably due to the predominance of production to orders in this sector. Finally, when the demand surprise indicator is significant it has the good signs. By good signs we mean that when a firm has over-evaluated its future demand, it increases its probability of being in the excess demand (of good) regimes (IR=1, IR=2) and decreases its probability of being in the excess supply (of good) regimes (IR=3, IR=4).

For our second set of results, we introduce the macroeconomic variables that were suggested in Section 1 and constructed in Section 2. We only give here a few representative results.

Sector 2: Intermediary Goods

IR / IR1	MSD	IGS	ISB	UTP = 6.43%
0	0 (+,+,-,-)	81	$0.12.10^{-4}$ (-,0,0,+)	

IR / IR1	MSD	IGS	IGS1	IGS2	IGS3	UTP = 5.45%
0	0 (+,+,-,-)	57	$0.12.10^{-8}$ (+,0,0,-)	$0.10.10^{-8}$ (-,0,0,+)	10	

IR / IR1	MSD	IGT	IGT1	IGT2	IGT3	UTP = 21.20%
0	0 (+,+,-,-)	25	5.46 (0,-,0,0)	1.31 (-,0,+,0)	15	

In this sector a stimulus on total public expenditures has after 6 months (IGT2) the expected effect of decreasing the probability of being in the Keynesian unemployment regime. Sectorial public expenditures do not have, however, a clear effect. A possible explanation is the following: In the short run public expenditures have no effect (IGS); since public expenditures are increased during Keynesian unemployment periods, we observe an unexpected negative effect (IGS1); finally an effect in the expected direction emerges after 6 months (IGS2). The sectorial cost of labor indicator (ISB) has significant effects and behaves as an indicator of purchasing power since a stimulus leads to a decrease in the probability of being in the Keynesian unemployment regime and to a simultaneous increase in the probability of being in the repressed inflation regime. This latter remark actually holds for all sectors.

Sector 3: Professional Equipment

IR / IR1	MSD	IGS3	ISB	UTP = 92.7%
0	$0.14.10^{-3}$	14	$0.25.10^{-2}$	
	(+,+,-,-)		(-,0,0,+)	

IR / IR1	MSD	IGS1	IGS2	IGS3	ISB	UTP = 76.8%
0	$0.12.10^{-3}$	25	10	3.79	$0.17.10^{-2}$	
	(+,+,-,-)			(-,0,0,0)	(-,0,0,+)	

When sectorial public expenditures have significant effects (in general after 9 months: IGS3) they have the expected signs since a stimulus on public expenditures decreases the probability of being in the Keynesian unemployment regime.

Sector 4: Automobile and Transportation

IR / IR1	IGS1	ISG2	ISN	UTP = 39.3%
0	0.72	$0.13.10^{-2}$	$0.28.10^{-2}$	
	(-,0,0,0)	(-,0,0,0)	(-,0,0,0)	

IR / IR1	IGS1	IGT2	ISB	ISB1	ISN	UTP = 35.7%
0	4.97	0.51	0.94	6.5	$0.47.10^{-1}$	
	(0,0,0,-)	(-,0,0,0)	(-,0,0,+)		(-,0,0,0)	

Sectorial and total public expenditures (IGS and IGN) are often significant with the correct signs. The indicator of purchasing power ISN plays the expected role since a stimulus on ISN decreases the probability of being in the Keynesian unemployment regime.

Sector 5: Consumption Goods

IR10 / IR11	MSD	IGT3	ISN	UTP = 17%
0	$0.78.10^{-12}$	0.03	$0.2.10^{-7}$	
	(+,+,-,-)	(-,-,0,+)	(-,0,0,+)	

IR10 / IR11	MSD	IGS2	IGS3	IGT2	IGT3	UTP = 27.6%
0	$0.11.10^{-11}$	$0.97.10^{-9}$	$0.41.10^{-1}$	39	1.87	
	(+,+,-,-)	(-,0,-,+)	(+,0,+,-)		(-,-,0,0)	

IR / IR1	MSD	IGS1	IGS2	IGS3	ISB	UTP = 56.7%
0	$0.13.10^{-11}$	10	2.31	$0.13.10^{-3}$	48	
	(+,+,-,-)		(0,0,0,+)	(+,0,0,-)		

In this sector total public expenditures after 9 months (IGT3) and sectorial public expenditures after 6 months (IGS2) have significant effects with the correct signs. Sectorial public expenditures after 9 months (IGS3) have significant effects but with the incorrect signs. The indicator of purchasing power ISN is strongly significant with the expected signs, while the sectorial real cost of labor indicator ISB is not significant.

5. Conclusion

This preliminary study has drawn the following results. First, the stability of the results with respect to the various sectors is striking.

In all sectors we found that demand surprises are very significant in explaining the disequilibrium regimes with always the expected signs. The strong significance of demand surprises may support the view proposed by J. Green and J. J. Laffont (1981) in which prices are fixed within each period at levels that equate anticipated demand and supply. Disequilibrium regimes are then generated by unanticipated shocks. However, the strong significance of the lagged regime indicator does not quite agree with such a view.

The fact that increase in public expenditures tends to decrease the probability of being in the Keynesian unemployment regime was clearly shown with a lag of 6 to 9 months. This result does not have, however, the stability of the previous ones. Our difficulties to obtain clear effects of public expenditures may be due to the endogeneity of this variable.

The index of purchasing power when significant has the right sign in the sense that an increase in this variable tends to decrease the probability of being in the Keynesian unemployment regime. We were, however, unable to exhibit the positive impact of an increase in the sectorial wage level on the probability of being in the classical unemployment regime. When this variable is significant it plays in fact the same role as a purchasing power variable.

Finally, we must note that our analysis is hindered by the predominance of the Keynesian unemployment regime. Our inability to make in evidence the effect of sectorial real wages on the probability of being in the classical unemployment regime may be due to this characteristic of our sample.

FOOTNOTES

* Support from DGRST 81-E-1303 is gratefully acknowleged. We are indebted to E. Malinvaud and B. Ottenwaelter for giving us access to the individual data collected by INSEE.

1. The possibility of using such surveys for analyzing the disequilibria was also suggested by E. Malinvaud (1981) and P. Kooiman (1982).

2. When $\hat{y}_{it} < d^a_{it} < \bar{y}_{it}$ we say that firm i is constrained on both markets on the presumption that it could satisfy a larger demand by drawing on its inventories. However, we attribute the case $d^a_{it} < \hat{y}_{it} < \bar{y}_{it}$ to Keynesian unemployment but it could sometimes be in the underconsumption regime if the firm produces to increase its inventory.

3. We present here only the questions of the INSEE surveys that we use. For more details on these surveys, see e.g., M. B. Bouissou, J. J. Laffont, and Q. H. Vuong (1983a).

4. The same variable was used by H. Konig, M. Nerlove, and G. Oudiz (1981).

5. Two more complex methods of constructing the indicators IQ and IL from the INSEE surveys were tried. For more details, see M. B. Bouissou, J. J. Laffont, and Q. H. Vuong (1983a).

6. The other result obtained by these authors is a great jump in

Keynesian unemployment at the end of 74, i.e., just following the first oil crisis. Though this second result cannot be observed with the present method of constructing IR due to missing data, it can however be observed with the second method of constructing IR that was studied in M. B. Bouissou, J. J. Laffont, and Q. H. Vuong (1983a).

7. For more details on how these indicators as well as their latent continuous variables were constructed from the series available in the Comptes Nationaux Trimestriels, see M. B. Bouissou, J. J. Laffont, and Q. H. Vuong (1983a).

8. Any of these assumptions can actually be tested. For instance, M. B. Bouissou, J. J. Laffont, and Q. H. Vuong (1983b) have derived some readily applicable tests of Assumption A.4 when there are no macro variables Z_t.

9. The fact that we need here Granger-Sims strict exogeneity and not R. F. Engle, D. Hendry, and J. F. Richard (1983) weak exogeneity follows from the fact that we are estimating conditional models.

10. All our empirical results were obtained by using the program CALM written by J. P. Link. This program estimates conditional ANOVA log-linear probability models (for the theory, see Q. H. Vuong (1982)).

11. This test can be thought of as a specification test. For formulas giving the appropriate degrees of freedom of the chi-square statistic, see S. J. Haberman (1974) and Q. H. Vuong (1982).

12. As mentioned in Section 3, the ANOVA parameterization is used. Since IR has 4 categories, it follows that the (bivariate) effect of an explanatory variable with J categories is characterized by $4 \times J$ ANOVA parameters of which $3 \times (J-1)$ are independent due to the usual ANOVA constraints. Hence, when $J=2$ it suffices to give the signs of the ANOVA parameters associated with the first category of the dichotomous variable.

REFERENCES

Anderssen, E. B.: <u>Conditional Inferences and Models for Measuring</u>. Copenhagen: Mentalhygiejnisk Forlag, 1973.

Artus, P., G. Laroque, and G. Michel: "Estimation d'un modèle macroéconmique trimestriel avec rationement," mimeo, INSEE, 1982.

Bouissou, M. B., J. J. Laffont, and Q. H. Vuong: "Econométrie du Déséquilibre sur Données Microéconomiques," Working Paper No 8308, GREMAQ, Université des Sciences Sociales de Toulouse, 1983.

——————: "Tests of Non-Causality under Markov Assumptions on Qualitative Panel Data," Social Science Working Paper No. 501, California Institute of Technology, 1983.

Chamberlain, G: "The General Equivalence of Granger and Sims Causality," <u>Econometrica</u>, 50 (1982), 569-581.

Engle, R. F., D. Hendry, and J. F. Richard: "Exogeneity," <u>Econometrica</u>, 51 (1983),277-304.

Fair, R. C., and D. M. Jaffee: "Methods of Estimation of Markets in Disequilibrium," <u>Econometrica</u>, 40 (1972), 497.

Green, J., and J. J. Laffont: "Disequilibrium Dynamics with Inventories and Anticipatory Price Setting," <u>European Economic Review</u>, 16 (1981), 199-221.

Haberman, S. J.: <u>The Analysis of Frequency Data</u>. Chicago: University of Chicago Press, 1974.

Konig, H., M. Nerlove, and G. Oudiz: "On the Formation of Price Expectations: an Analysis of Business Data by Log-Linear Probability Models." <u>European Economic Review</u>, 16 (1981), 130-144.

Kooiman, P.: "Using Business Surveys Data in Empirical Disequilibrium Models," ICERD, London School of Economics.

Laffont, J. J.: "Fix-Price models: a Survey of Recent Empirical Work," Working Paper No 8305, GREMAQ, Université des Sciences Sociales de Toulouse, 1983.

Malinvaud, E.: <u>Réexamen de la Théorie du Chomage</u>. Paris: Calman-Levy, 1980.

——————: "Econometric Implications of Macro-Disequilibrium Theory," mimeo, INSEE, 1981.

McFadden, D.: "Conditional Logit Analysis of Qualitative Choice Behavior," in <u>Frontiers in Econometrics</u>, ed. by P. Zarembka. New York: Academic Press, 1974.

Muellbauer, J.: "Macrotheory versus Macroeconometrics: the Treatment of "Disequilibrium" in Macro Models," mimeo, Birbeck

College.

Nerlove, M., and S. J. Press: Univariate and Multivariate Log-Linear and Logistic Models. Santa Monica: Rand Corporation, 1973.

———: "Multivariate Log-Linear Probability Models for the Analysis of Qualitative Data," Discussion Paper No 1, Center for Statistics and Probability, Northestern University, 1976.

Quandt, R.: "Econometric Disquilibrium Models," mimeo, Princeton University.

Vuong, Q. H.: "Conditional Log-Linear Probability Models: A Theoretical Develpoment with an Empirical Application," Ph.D. Thesis, Department of Economics, Northwestern University, 1982.

———: "Misspecification and Conditional Maximum Likelihood Estimation," SSWP No. 503, California Institute of Technology, 1983.